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ABSTRACT

When designing a computerized drill and practice lesson, the teacher should (1) select the content and processes of the lesson to match the content and processes of the initial instruction, (2) present a variety of stimulus presentations for an item, (3) select constructed or non-constructed response modes by the type and complexity of the material being practiced, (4) provide appropriate feedback for a student's response, (5) systematically select the next appropriate item to be presented, (6) have some appropriate lesson termination strategy, and (7) update records and report the student's score in some meaningful manner. A sample program of a general drill and practice lesson is presented and described. This resource for preservice and inservice teacher training provides study questions and a 14-item bibliography. (Author/CMV)

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Number 7e

Illinois Series on Educational Application of Computers

DRILL AND PRACTICE
ON
A COMPUTER

James T Stewart

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To the reader,

This is one of a series of documents prepared as resources for the preservice and inservice training of teachers. The general theme of all items in this series is "teaching with or about computers". The booklets are the collective work of a variety of staff and students (both present and former) of the College of Education, University of Illinois at Urbana-Champaign. The project generously was supported between 1977 and 1979 by a grant from the EXXON Education Foundation. All responsibility for the content of these documents rests with the authors and does not reflect necessarily the views of the EXXON Foundation. It was my extreme pleasure to direct this effort throughout.

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DRILL AND PRACTICE ON A COMPUTER

After students have received instruction in a content area, it is often necessary to allow them to practice using the new ideas. Homework traditionally has been used for this purpose. Other lessons require that the students memorize material, some of which is needed in learning other parts of the subject. For example, students must have a rapid recall of the basic addition and multiplication facts in order to increase their efficiency in completing the standard algorithm for multiplying multidigit numbers. These drill and practice activities make up a large portion of the instruction found in many classrooms. There are certain principles which apply to drill and practice lessons in general and to computerized drill and practice lessons in particular. This paper will introduce you to these principles.

The complexity or sophistication of the drill or practice exercise depends upon the difficulty level of the content and complexity of the processes in the specific type of learning setting. Gagne (1970) has identified eight types of learning:

LEARNING TYPE	BRIEF DESCRIPTION
1) Signal Learning	Classical Conditioning.
2) Stimulus-Response	Operant Conditioning.
3) Chaining	Two or more S-R connections.
4) Verbal Associations	Chains that are Verbal.
5) Multiple Discrimination	Responses to stimuli that resemble each other.
6) Concept Learning	A common response to a class of stimuli.
7) Rule Learning	A chain of two or more concepts.
8) Problem-Solving	Thinking is involved; principles are combined according to a "higher order" rule.

Drill and practice exercises can be written for any one of these types of learning. The content of a specific exercise then merely utilizes the content and processes of the particular type of learning. For example:

Concept taught: "Round"

Exercise for drill: The student is presented with various shapes and asked to respond to the ones that are "round".

However, there are three general psychological constructs which influence each type of learning. Stolurow (1974) gives a good description of each:

1) Generalization--"associative (sequences) in which the learner makes the same response to different things". For example: presenting the student with different objects such as a pie plate, a Frisbee, and a circle and having him respond "round".

2) Discrimination--"associative sequences in which the learner makes different responses to different things". For example: presenting objects such as triangles, circles and squares and having the student respond with "round" or "not round".

3) Transfer--"the learner is able to perform in a manner consistent with his previously learned performance, when in a changed situation, one that is different from his acquisition situation". For example: utilizing a combination of separately taught skills in solving a problem.

While drill and practice exercises may include the content and process of each of Gagne's eight types of learning, the lessons may also be structured as Generalization, Discrimination or Transfer situations.

Within this structure it is usually found that drill exercises involve lower level skills acquisition than practice exercises. Drills usually are used in memorization, quick recall, or distinguishing among objects in a set. Practice exercises are associated with processes such as learning algorithms or combining concepts to solve problems.

LESSON DESIGN

Whatever configuration the content being studied may assume, the drill and practice exercise will have the following structural characteristics:

- 1) A Stimulus is presented and a Response is elicited.
- 2) The response is judged and appropriate Feedback is given.
- 3) The stimulus is repeated to assure that the correct response has been learned.

Stimulus Presentation

The first step in a drill and practice lesson is the presentation of the stimulus. The stimulus usually is in the form of a question. Questions may be selected from item pools or may be written specifically from the material of a tutorial lesson. A discussion of computerized item pools may be found in ISEAC no.12 titled "Computer Assisted Test Construction". Also, the material in ISEAC no.4, "Design of Questioning Episodes", is valuable background for writing or selecting tasks for drill or practice lessons.

The stimulus must be representative of the material that was taught in the lesson. If concept discrimination between "round" and "not-round" was the content of the lesson, then the practice items must be discriminatory tasks and not generalizing tasks (as in listing the round objects in the room). In other words, the practice task must fit the instruction. Another consideration when designing practice items is the level of difficulty of the item. If you are introducing the concept "round", you would not want to have practice items which contain ovals or half-circles which are found in the "gray" areas of the concept. The items should be selected from the material that was presented.

A design technique used to increase the probability that the student actually learns the material is to vary the format used in constructing the stimulus for an item. For example, in the accompanying program, (refer Appendix A for the listing of the program or refer to the section titled DAPL Program Documentation) the student is to practice his knowledge of paired associates (chemical name and symbol). If the student has the knowledge firmly in mind and is able to give the correct symbol when presented with a name, he also should be able to give the correct

name when presented with the symbol. The change in the presented stimulus should separate students who know the material from students who have memorized only a single stimulus-response pair. Varying the presentations will lessen the temporary memorization factor and increase the probability that the desired knowledge is retained.

When writing a question, certain techniques can be used to assist the student in getting the correct answer. These techniques utilize helpers called "prompts" or "cues". Prompting early in a practice program helps build confidence and allows the student to organize his previous learning in the content of the practice lesson. Research has shown that use of "advanced organizers" increases achievement in lessons (Barnes, 1975). Following are some prompting techniques which may be useful:

- 1) Position the task in a sequence that draws the student's attention to the obvious answer.
- 2) Underline the words which are important to understanding the solution.
- 3) Construct the size of the answer space to reflect the size of the desired answer.
- 4) Construct the answer space with dashes to represent the letters of the desired answer.
- 5) Place starting or stopping letters in the answer space. This is particularly useful with suffixes and prefixes of words.
- 6) Provide graphic illustrations which will reveal the desired answer.

Using illustrations as prompts can be useful unless the student becomes dependent upon the picture as the stimulus and response without processing the information in the task or question. Illustrations can also become distracting when they are not pertinent to the solution of the task. Only include those diagrams, charts or illustrations that are necessary for the solution of the task. The prompting procedures should occur early in the exercise session and should be withdrawn quickly. Prompting or cueing usually is needed only in Tutorial style lessons where the material being presented is entirely new to the student. However, prompting can be included in the initial presentations of a drill and practice lesson to insure students' early successes.

Response Elicited

Originally, when computerized or programmed drill and practice lessons were constructed, students were required to construct an answer to the task that was presented. Lesson designers felt that the constructed response was necessary to show that learning had occurred. Subsequent research on the matter demonstrated support for the constructed answer format. However, other studies began to suggest that a "selected" answer, as in a multiple choice format, also gave good results on achievement tests. Researchers then began to review their previous work.

It was found that three factors were influencing the response mode question. First, the material itself was usually filled with enough prompts and cues so as to assure that the student frequently had the correct answer whether he was selecting the answer or composing it. Using a "Black-Out" technique for obscuring portions of the text in order to evaluate superfluous information in tasks, researchers were able to explain some conflicting results by noting the amount of "extra" material that was presented in the task without changes in learning results (Kenp and Holland, 1966). Second, the difficulty of the content influences the type of answer that was effective. In highly technical material a constructed response has been found to be more effective. In less technical material there is little difference in constructed or selected answer modes. Third, familiarity with the material influences how the student best learns it. With unfamiliar material, the student learns best with the constructed response mode. For information which is familiar or can be related to familiar material, either mode is appropriate and negligible achievement differences would be expected.

There is one advantage to the selected response mode and that is in saving time. Most constructed response task items take at least twice as long to answer as the selected style of responding. This time difference suggests that the increased achievement in the overtly constructed mode may be due to the fact that the mode forces the student to spend more time processing the material. What the response mode issue most vividly demonstrates is that the response must be meaningful to the student. If the student can answer the question without processing the information in the task, then the question style is not effective and should be revised.

Generally in drill and practice lessons where the student has had previous instruction in the content of the lesson, either mode is applicable. The less time-consuming selected answer format may be desirable to avoid long lessons (thus reducing student fatigue) and to allow larger numbers of students to use the computer facilities.

Response Evaluation

Once the student has responded to a task, it is necessary to evaluate that response and present some form of "feedback" as to the appropriateness of the response. In early lesson design technique the Known Correct Response (KCR), the correct answer, was presented to the student. It was believed that the KCR would act as a "reinforcer" of the response. However, subsequent research showed that comparable achievement was exhibited by groups which received feedback and groups which received no feedback after a response.

It was found that some members of the feedback groups were looking ahead at the next task which contained the KCR for the previous task. This "cheating" lowered the feedback group achievement scores since they were not processing the information even though they might have had an error-free program. The no-feedback group, however, was receiving enough prompting from the material so as to assure that its responses were correct and that, in effect, it was receiving feedback even though there was no formal presentation of the KCR. The non-feedback achievement scores were thus higher than would be expected. Anderson, Kulhavy and Andre (1976) used a computer to control access to feedback information and prevent students from looking ahead and, thus, "cheating". They were able to show a superior performance of the feedback group versus the no-feedback group on achievement tests following an instructional program.

The theory explaining the application of feedback initially stated that feedback must be given immediately following the response. Studies have shown that KCR administered later in time was as effective as, and, in some cases, more effective than the immediate feedback. Due to the effectiveness of the delayed feedback studies, the theory was changed from feedback being a form of reinforcement to it being a form of answer verification or correction. When the student answers a question incorrectly, providing the correct response acts to correct the error. When the student answers a question correctly, feedback acts to verify the correctness of his response.

In the case of an incorrect response, the corrective feedback should be closely related to the type of error that has occurred. A simple "no" or "wrong" should be avoided. If a student is working in a regular classroom, the teacher is able to identify mistakes and to provide appropriate remedial action. However, the computer lacks the infinite flexibility of the teacher. Responses to predictable errors can be programmed into a lesson, however, all unpredicted errors must be assumed to be caused by lack of appropriate knowledge. For unpredicted errors, usually the only

remedial action which can be built into a computerized lesson is to reveal the correct response.

A common cause of error (other than spelling or typing mistakes) in computerized drill and practice lessons is confusion among members within the practice set. Consider, for example, the accompanying chemical symbol program. When presented with the symbol "I", the student may respond with Iodine (correct) or Iron (incorrect). Iron has been seen previously in the lesson and is being confused with Iodine. If the student chooses the incorrect response, he should be corrected and then given immediate practice on discriminating between the two confusing items. Any time an "in-list" error occurs, the student should be given instruction on the difference between the items and then given immediate practice on those items. The troublesome item is then recycled in the program. (This recycling technique will be discussed later in the paper.)

After verification feedback is given to a correct response, additional comments called "social evaluative feedback" sometimes are provided. Early lesson designers believed that positive reinforcement was necessary for learning. However, Frase (1963) and Parisi (1965) have shown that this type of comment apparently is not necessary. In these studies, the groups which recieved negative comments after incorrect answers appeared to do better on the achievement test after the program when compared with groups receiving only positive comments on correct responses or no comments at all. If we evaluate these findings in light of the other feedback results discussed above, we find similar mechanisms in operation.

Students in these studies studied "errorless" programs that progressed in small steps. The students would tend to have high confidence in their answers. They tend to be "shocked" when they get an incorrect answer and may devote more time to that task in review. Also, they may be more attentive in the succeeding tasks. Students having a high confidence level who get an item correct are not likely to be influenced by being told they are doing well. They are aware of the fact and tend to ignore such comments. Also, if there is a high rate of correct answers in a program and social evaluative comments are provided, the student reaches a saturation level where there is little effect of susequent comments. Varying the wording of the comment or displaying comments on an intermittent schedule may have some effect on learning and attention.

Branching Techniques

After the student's response has been evaluated and the appropriate records updated, the next practice item must be selected. The decision as to which item is to be presented next is known as "branching" the student to appropriate material. The easiest form of branching is the straight line style. In it the student proceeds in a straight line from the first item to the last without any side trips to remedial or explanatory material. All of the students using the program see all of the material. This style of program is easily accomplished with pencil and paper. In its more complex form, branching takes place when a student is routed to different items depending upon his response to a preceding item or items. Incorrect responses can be corrected, additional practice provided, or advanced material presented.

Branching also is useful in assuring that the student possesses the required information. If the student's response to a first presentation of a question is correct, there is only a small guarantee that the student, in fact, understands the content of that question. However, if the student is able to answer the question correctly on repeated presentations, the probability that he understands the material increases with each correct response. Questions which are answered correctly should be presented later to increase the probability that the student has the desired knowledge.

Of course, one may be able to remember a previously guessed correct answer. A branching method used to reduce the temporary retention of the hastily memorized correct answer is to visit the correctly answered questions after several other items have been presented. This intervening material will help to extinguish the remembered answer and provide interference for the memorized response. For the student who truly understands the material or actually possesses the knowledge, the intervening questions will have little disruptive effect. He again will be able to respond correctly to the item. After several separate correct responses, the item should be retired from the presentation sequence.

If the student's response to the first presentation of an item is incorrect, then the correct response should be revealed and the item presented several more times to aid in remembering the answer. The presentation of the corrected item should not be too delayed since the intervening questions will interfere with remembering the given correct answer. Several branching schedules have been developed for recycling incorrectly answered items. One such schedule is a "2-3-4" sequence. If a question is missed, the item is then entered as the second (item+2), fifth (item+2+3) and ninth (item+2+3+4) question in the presentation sequence. You

will note that the next presentation after initially missing the item is not immediately after the item but one question later in the sequence. This delay is used to insert a small amount of interference to the presented correct answer but not so much as to extinguish it completely. The interval is increased between presentations to increase the amount of interference. However, the item is, hopefully, being answered correctly and the correct response is being reinforced and remembered. When the initially incorrect item is being answered correctly, it also is being recycled to the end of the list in the format for handling correct answers. In this scheme, a question which initially is answered incorrectly could appear at least six more times.

With a provision for recycling incorrect items, students are given extra practice in the specific individual areas which need improvement. With a provision for recycling correct items, students are able to demonstrate and reinforce the knowledge that they possess.

Program Termination

When designing a drill and practice lesson, the writer must consider procedures for ending the program. Lengthy drill and practice sessions can become very boring for the student. Sessions should be short and have a limited number of practice items or should be arranged so that the student may elect to stop the session at any time. The decision to end a lesson may be based on various factors. 1) The student may be required to see all of the material in a lesson. 2) The lesson may be terminated after a certain number of correct or incorrect answers. 3) The lesson may have a time limit and when it is reached, the program counts the number of questions attempted and correctly answered etc.

The last procedures in a drill and practice lesson should be the updating of cumulative records and the reporting of student achievement. The teacher will find a computer to be a very useful tool in keeping records of student work. The number of correct responses, the difficulty of the material, or the time a student used to execute a lesson are possible items to be recorded. Information in cumulative data files is extremely useful when assessing student achievement over time. Once data files have been updated, the scores should be reported to the students. A brief evaluative statement might accompany a numerical score. For example, it might be reported how a student performed relative to others in the class or relative to previous attempts at the same material, a projected grade evaluation based upon this demonstrated performance level might be reported. Generally, there should be some verbal explanation of any numerical result of an exercise.

SUMMARY

When designing a computerized drill and practice lesson, the following considerations should apply:

- 1) Select the content and processes of the lesson to match the content and processes of the initial instruction.
- 2) Present a variety of stimulus presentations for an item.
- 3) Select constructed or non-constructed response modes by the type and complexity of the material being practiced.
- 4) Provide appropriate feedback for a student's response. In the case of an incorrect response, the corrective feedback should match the error. In the case of a correct response, social evaluative statements should be varied to avoid redundancy.
- 5) Systematically select the next appropriate item to be presented. Recycle initially correct items to demonstrate that knowledge is actually present. Recycle initially incorrect items more frequently and earlier than correct items to give additional and more immediate practice.
- 6) Have some appropriate lesson termination strategy.
- 7) Update records and report the student's score in some meaningful manner.

STUDY QUESTIONS

- 1) Look at a practice list in a text from your field. What features to facilitate or guarantee learning are missing?
- 2) Identify two or three places in a subject you (will) teach where practice is appropriate.
- 3) Prepare a practice question-answer set. Implement it in the program DAP1 which follows.

DAPI PROGRAM DOCUMENTATION

In the program DAPI, an attempt has been made to make the program as flexible and as adaptable as possible. The flexibility is in two areas. 1) flexibility in using the program with a variety of content (the use of string variables to hold and display question statements or the non-specific correct and incorrect statements). 2) Flexibility in adaptation to other machines (using only one dimensional arrays or using simple easily adaptable statements). An adaptation which would be extremely useful and time saving would be the use of external data files. Generally the only statements which would have to be changed are at the beginning of the program. The MAT READ statements must identify the file number and the program must identify the file name. Additional data output-to-file statements must be added to save records from the program. They may be added in the score reporting section after line 540 or at the end of the program and change line 550 to go to the record update routine.

In the accompanying program, an incorrect response subtracts one from the "correct counter" and an initially incorrectly answered item will appear only four times. This provision allows for shorter programs which will lessen the fatigue of the student and lower the amount of time a terminal is tied up by one student. An additional check which might be provided is an "incorrect counter". If a student is making a large number of incorrect responses, he obviously is not prepared for practice on the material and the program should be terminated with some form of remedial action taken. The incorrect counter merely keeps track of the number of questions missed and terminates the program when a predetermined number is reached. A message is printed to the student to consult with the instructor or to review the material.

In this program, items are retired after the third correct response unless incorrect responses are made during the sequence. The reader might note that even though there are only ten practice items, with the recycling provision, the student may see over 30 presentations.

General Procedure

The program operates on a list of questions to be presented which is kept in array N(100). The array initially is loaded with values 1 to 10 in lines 110-130. N(100) is a circular list and as the array becomes full, it "wraps around" to the beginning allowing for an "infinite" list (at least until the "head" catches up to the "tail" of the list). This circular aspect of the

program necessitates several additional statements and procedures. If a limited amount of memory is available, the program can be shortened by using a straight line list and checking for "overflow" at appropriate places.

The variable M identifies the current cell in N(100) which is being used. Therefore, N(M) is a value from 1 to 10 which identifies some question/answer pair. The question/answer pair is stored in arrays QS(10) and AS(10). M is incremented and checked for size in lines 210-230.

The variable T identifies the "top" of the list. This is the next available cell in N(100) for entry of correct recycle response items. Initially, cells 1 through 10 are filled with values 1 through 10 and thus T is set to 11.

Once an item has been presented, the cell N(M) identifying that item is reset to 0. If N(M)=0, then that cell is empty and capable of accepting a value. This is used in the correct and incorrect recycling routines.

In order to determine the point at which the program should be terminated, a count of correct responses to each question is kept. Array S(10) is used for this purpose. Each item must be answered correctly three times in order to be "retired" from the presentation. When all of the items have met the three-time correct answer rule, the program ends. This check is accomplished in lines 600-620 of the correct answer routine. The program cannot end on an incorrect answer. Line 250 checks to see if the item has been answered correctly three times and thus, should not be presented again.

Program Flow

Lines 10 through 130 initialize the variables and load the data into the appropriate arrays. For machines without matrix manipulation statements, the MAT READ statements may be replaced with for/next loops.

The main procedure begins at line 200. M is incremented and checked, the presented item counter (P) is incremented and the value in cell N(M) is checked for validity (lines 200-260). Line 270 randomly generates either 1 or 2, and line 280 branches to the appropriate presentation. This feature allows for a variety of presentations of the material. Lines 290-340 are presentation number 1 and lines 350-390 are presentation number 2. Within these groups, the question is presented, the response input by the student, the correct answer saved in AS and the answer checked for being correct.

The correct answer routine begins at line 500. A comment "generator" provides one of four comments based on a randomly generated number. Whenever a student answers an item correctly, a number 1 through 4 randomly is generated and a statement presented based upon that number (lines 510-540). The appropriate cell in S(10) is incremented (line 550), the correct item is recycled to the top of the list (line 560), the top of the list is incremented and checked (lines 570-590) and the array S(10) is checked to determine if it is "full" (e.g., each entry is a 3) and the program should end.

In the incorrect answer routine, lines 710-730 and 800-820 check for an "in-list" error (confusion among members in the practice set). If this type of error is found, lines 750-790 and 840-880 print the appropriate message. Variable B identifies the return position when the procedure is complete (see line 1000). The item is then recycled beginning at line 900. The wrong item counter (W) is incremented and the S(10) array decremented. Lines 930-990 represent the recycling algorithm. The program attempts to identify if the cells 2-5-9, identified by Q, away from the item are empty (line 970). If the cell is available, the value in N(M) is placed in the cell. If not, the values above that cell must be saved and then the cell filled with N(M).

The "bump-down" subroutine beginning in line 1200 is divided into three parts. Lines 1240-1250 determine which part is to be used. Lines 1370-1460 are used if the top (T) has wrapped around but M has not and M is large enough so that if 2, 5 or 9 are added to it, it will be greater than 100 (overflow the list size). Lines 1260-1350 are used if T has wrapped around but M+2, 5 or 9 is less than 100. Lines 1480-1520 are used if T has not wrapped around. Within these parts, the cells in N(100) are filled with the contents of the cell below and then the top is incremented.

When the subroutine returns to line 990, the value in N(M) is saved. After this procedure is completed for 2, 5 and 9 cells, the program returns to the appropriate position. In the case of out-of-list or unpredicted errors, the correct answer is revealed (lines 1010-1040) and the program returns to line 200.

The data for presentation is located in lines 1600-1650 in the following format:

line 1600 Question T1\$ for data in line 1620.
 line 1610 Question T2\$ for data in 1630.
 line 1620 Data for array Q\$(10).
 line 1630 Data for array AS(10) (First 5 items).
 line 1640 Data for array AS(10) (Last 5 items).

line 1450 Data for correct response statements in
CS(4).

Notice that the items in QS(10) and AS(10) hold
corresponding positions in the arrays. For
example, the chemical name 'nitrogen' is found in
AS(3) and its corresponding symbol is found in
QS(3). They both are in the third position of the
respective data lists. When altering the data,
maintain this corresponding relationship of QS and
AS data.

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PROGRAM DAP1

```
10 REM          GENERAL DRILL AND PRACTICE LESSON
20 DIM QS(10),AS(10),N(100),S(10),CS(4)
30 REM          INITIALIZE VARIABLES AND LOAD DATA
40 READ T1$,T2$
50 MAT READ QS,AS,CS
60 MAT S=ZER
70 LET M=0
80 LET T=11
90 LET P=0
100 LET W=0
110 FOR I=1 TO 10
120 LET N(I)=I
130 NEXT I
200 REM          MAIN PROCEDURE STARTS HERE
210 LET M=M+1
220 IF M<101 THEN 240
230 LET M=M-100
240 LET P=P+1
250 IF N(M)=0 THEN 200
260 IF S(N(M))<2 THEN 270
263 GOSUB 1550
265 GOTO 200
270 LET Z=INT(RND(-1)*2+1)
280 ON Z GOTO 290,350
290 PRINT
300 PRINT T1$;QS(N(M));" ?"
310 INPUT VS
320 LET BS=AS(N(M))
330 IF VS<>AS(N(M)) THEN 700
340 GOTO 500
350 PRINT
360 PRINT T2$;AS(N(M));" ?"
370 INPUT WS
380 LET BS=QS(N(M))
390 IF WS<>QS(N(M)) THEN 800
500 REM          CORRECT ANSWER ROUTINE
510 LET R=INT(RND(-1)*4+1)
520 PRINT
530 PRINT CS(R)
540 PRINT
550 LET S(N(M))=S(N(M))+1
560 LET N(T)=N(M)
565 LET N(M)=0
570 LET T=T+1
580 IF T<101 THEN 500
590 LET T=T-100
600 FOR J=1 TO 10
610 IF S(J)<=2 THEN 200
620 NEXT J
630 PRINT
640 PRINT "YOUR SCORE IS ";((P-W)/P)*100;" %"
650 GOTO 9999
700 REM          INLIST INCORRECT ANSWER CHECK
710 FOR K=
```

```

700 REM          INLIST INCORRECT ANSWER CHECK
710 FOR K=1 TO 10
720 IF VS=AS(K) THEN 750
730 NEXT K
740 GOTO 890
750 PRINT
760 PRINT VS;" IS NOT THE CORRECT ANSWER FOR ";QS(N(M));"."
770 PRINT "THE ANSWER FOR ";VS;" IS ";QS(K)
780 LET B=1
790 GOTO 900
800 FOR K=1 TO 10
810 IF WS=QS(K) THEN 840
820 NEXT K
830 GOTO 890
840 PRINT
850 PRINT WS;" IS NOT THE CORRECT ANSWER FOR ";AS(N(M));"."
860 PRINT "THE ANSWER FOR ";WS;" IS ";AS(K)
870 LET B=2
880 GOTO 900
890 LET B=3
900 REM          INCORRECT ANSWER RECYCLE ROUTINE
910 LET W=W+1
920 LET S(N(M))=S(N(M))-1
930 LET Q=0
940 LET L=M
950 FOR J=2 TO 4
960 LET Q=Q+J
970 IF N(L+Q)=0 THEN 980
975 GOSUB 1200
980 LET N(L+Q)=N(M)
990 NEXT J
1000 ON B GOTO 230,350,1010
1010 PRINT
1020 PRINT "THE CORRECT ANSWER IS ";BS
1030 PRINT
1035 LET N(M)=0
1040 GOTO 200
1200 REM          SUBROUTINE TO BUMP-DOWN VALUES IN N( )
1210 REM          FOR INSERTION OF INCORRECT RECYCLE.
1220 REM          ROUTINE MUST ACCOUNT FOR WRAP AROUND
1230 REM          LOOPING IN QUEUE N( )
1240 IF T>M THEN 1470
1250 IF M+Q>100 THEN 1370
1260 REM *****
1270 FOR J=T TO 2 STEP -1
1280 LET N(J)=N(J-1)
1290 NEXT J
1300 LET N(1)=N(100)
1310 FOR J=100 TO M+Q STEP -1
1320 LET N(J)=N(J-1)
1330 NEXT J
1340 LET T=T+1
1350 RETURN
1370 REM *****
1380 FO

```

```

1370 REM *****
1380 FOR J=T TO (M+Q-100) STEP -1
1390 IF J=1 THEN 1420
1400 LET N(J)=N(J-1)
1410 GOTO 1430
1420 LET N(1)=N(100)
1430 NEXT J
1440 LET T=T+1
1450 LET L=M-100
1460 RETURN
1470 REM *****
1480 FOR J=T TO M+Q STEP -1
1490 LET N(J)=N(J-1)
1500 NEXT J
1510 LET T=T+1
1520 RETURN
1550 LET N(T)=N(M)
1552 LET T=T+1
1555 IF T<101 THEN 1560
1557 LET T=T-100
1560 RETURN
1600 DATA "WHAT ELEMENT HAS THE SYMBOL "
1610 DATA "WHAT IS THE SYMBOL FOR "
1620 DATA "O","W","N","H","I","NA","CL","FE","C","HE"
1630 DATA "OXYGEN","TUNGSTEN","NITROGEN","HYDROGEN","IODINE"
1640 DATA "SODIUM","CHLORINE","IRON","CARBON","HELIUM"
1650 DATA "VERY GOOD!","THAT IS CORRECT!","GOOD WORK","RIGHT!"
9999 END
READY.

```

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